REMARKS

The Office Action mailed February 21, 2007 has been carefully reviewed and the foregoing amendment has been made in consequence thereof.

Claims 1-31 are now pending in this application. Claims 1-21, 23, and 25-31 stand rejected. Claims 22 and 24 stand objected to.

Applicants acknowledge and thank the Examiner for the indication that Claims 22 and 24 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 22 and 24 were indicated as being allowable had they not been based upon a rejected base claim. Claims 22 and 24 depend from independent Claim 1. Claim 1 is submitted to be in condition for allowance. When the recitations of Claims 22 and 24 are considered in combination with the recitation of Claim 1, Applicants submit that Claims 22 and 24 are likewise in condition for allowance.

The rejection of Claims 1-7, 9, 10, 12, 17, 19, 21, 23, and 26-31 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 4,727,325 to Matsui et al. (hereinafter referred to as "Matsui") is respectfully traversed.

Matsui describes an NMR imaging method using a rotating field gradient, including a second step of generating field gradient in a predetermined direction to translate the position of signal in a phase space to appropriate locations, and a third step of generating a rotating field gradient to perform a measuring operation. The rotating field gradient produces a spiral or circular sampling of k-space which is then reconstructed through Fourier transformation or a combination of 2D interpolation and Fourier transformation to produce an image. Notably, Matsui does not describe or suggest phase encoding on to an elliptical grid in polar coordinates in a k-space.

Claim 1 recites a method for a medical examination, wherein the method comprises "polar phase encoding to generate a plurality of signals forming datasets representative of an object, wherein the datasets form an elliptical grid in polar coordinates in a k-space."

Matsui does not describe or suggest a method for medical examination, as recited in Claim 1. More specifically, Matsui does not describe or suggest phase encoding on to an elliptical grid in polar coordinates in a k-space, as required by Applicants' claimed invention. Rather, in contrast to the present invention, Matsui describes a method for magnetic resonance imaging that uses a spiral or circular sampling of k-space.

Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Matsui.

Claims 2-7, 9, 10, 12, 17, 19, 21, 23, 30, and 31 depend from independent Claim 1. When the recitations of Claims 2-7, 9, 10, 12, 17, 19, 21, 23, 30, and 31 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claims 2-7, 9, 10, 12, 17, 19, 21, 23, 30, and 31 likewise are patentable over Matsui.

Claim 26 recites a method for a medical examination, wherein the method comprises "sampling datasets on to an elliptical grid in polar coordinates in a k-space to generate signals representative of an object of interest that is being medically examined."

Matsui does not describe or suggest a method for a medical examination, as recited in Claim 26. More specifically, Matsui does not describe or suggest sampling datasets on to an elliptical grid in polar coordinates in a k-space, as required by Applicants' claimed invention. Rather, in contrast to the present invention, Matsui describes a method for magnetic resonance imaging that uses a spiral or circular sampling of k-space.

Accordingly, for at least the reasons set forth above, Claim 26 is submitted to be patentable over Matsui.

Claim 27 depends from independent Claim 26. When the recitations of Claim 27 is considered in combination with the recitations of Claim 26, Applicants submit that dependent Claim 27 likewise is patentable over Matsui.

Claim 28 recites a magnetic resonance imaging (MRI) system comprising "a main magnet to generate a uniform magnetic field; a radio frequency pulse generator for exciting the magnetic field; a gradient field generator for generating gradients extending in different directions in the magnetic field; a receiver for receiving magnetic field magnetic resonance (MR) signals representative of an object; and a controller for polar phase encoding to generate the MR signals forming datasets representative of the object, wherein the datasets form an elliptical grid in polar coordinates in a k-space."

Matsui does not describe or suggest a magnetic resonance imaging system, as recited in Claim 28. More specifically, Matsui does not describe or suggest a controller for polar phase encoding to generate the MR signals forming datasets representative of the object, wherein the datasets form an elliptical grid in polar coordinates in a k-space, as required by Applicants' claimed invention. Rather, in contrast to the present invention, Matsui describes an apparatus that includes a signal processing unit for encoding using a spiral or circular sampling of k-space.

Accordingly, for at least the reasons set forth above, Claim 28 is submitted to be patentable over Matsui.

Claim 29 recites a controller programmed to "polar phase encode to generate a plurality of magnetic resonance (MR) signals forming datasets representative of an object, wherein the datasets form an elliptical grid in polar coordinates in k-space."

Matsui does not describe or suggest a controller as recited in Claim 29. More specifically, Matsui does not describe or suggest a controller programmed to polar phase encode to generate a plurality of magnetic resonance (MR) signals forming datasets representative of an object, wherein the datasets form an elliptical grid in polar coordinates in a k-space, as required by Applicants' claimed invention. Rather, in contrast to the present

invention, Matsui describes an apparatus that includes a signal processing unit for encoding using a spiral or circular sampling of k-space.

Accordingly, for at least the reasons set forth above, Claim 29 is submitted to be patentable over Matsui.

Accordingly, for at least the reasons set forth above, Applicants respectfully request that the Section 102 rejection of Claims 1-7, 9, 10, 12, 17, 19, 21, 23, and 26-31 be withdrawn.

The rejection of Claims 1-7, 26, and 27 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent 6,486,670 to Heid (hereinafter referred to as "Heid") is respectfully traversed.

Heid describes a method for imaging with NMR. The first step is to read out MR signals under the influence of a magnetic gradient field with the direction of a gradient being modified during the reception so that the k-space trajectory proceeds on a curve. The MR signals are then sampled with the sampling rate varied such that an occupation density of k-space with samples is essentially uniform. The curved k-space trajectory produces a spiral sampling of k-space. Notably, Heid does not describe or suggest phase encoding on to an elliptical grid in polar coordinates in a k-space.

Claim 1 recites a method for a medical examination, wherein the method comprises "polar phase encoding to generate a plurality of signals forming datasets representative of an object, wherein the datasets form an elliptical grid in polar coordinates in a k-space."

Heid does not describe or suggest a method for medical examination, as recited in Claim 1. More specifically, Heid does not describe or suggest polar phase encoding to generate a plurality of signals forming datasets representative of an object, wherein the datasets form an elliptical grid in polar coordinates in a k-space, as required by Applicants' claimed invention. Rather, in contrast to the present invention, Heid describes a method for magnetic resonance imaging that uses a spiral sampling of k-space.

Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Heid.

Claims 2-7 depend from independent Claim 1. When the recitations of Claims 2-7 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claims 2-7 likewise are patentable over Heid.

Claim 26 recites a method for a medical examination, wherein the method comprises "sampling datasets on to an elliptical grid in polar coordinates in a k-space to generate signals representative of an object of interest that is being medically examined."

Heid does not describe or suggest a method for a medical examination, as recited in Claim 26. More specifically, Heid does not describe or suggest sampling datasets on to an elliptical grid in polar coordinates in a k-space, as required by Applicants' claimed invention. Rather, in contrast to the present invention, Heid describes a method for magnetic resonance imaging that uses a spiral sampling of k-space.

Accordingly, for at least the reasons set forth above, Claim 26 is submitted to be patentable over Heid.

Claim 27 depends from independent Claim 26. When the recitations of Claim 27 is considered in combination with the recitations of Claim 26, Applicants submit that dependent Claim 27 likewise is patentable over Heid.

Accordingly, for at least the reasons set forth above, Applicants respectfully request that the Section 102 rejection of Claims 1-7, 26, and 27 be withdrawn.

The rejection of Claims 1-7, 10, 14, 19, 20, and 25 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 6,794,869 to Brittain (hereinafter referred to as "Brittain") is respectfully traversed.

Brittain describes a system and method for acquiring data to reconstruct MR images across a large FOV with a reduced acquisition time and without discontinuities of the reconstructed images. The magnetic field gradients, used to excite spins, traverse k-space in

a uniform trajectory in the k-space dimension that is parallel to the motion of the examination table. The gradients that are perpendicular to the table motion are divided into subsets. The data is then Fourier transformed in the direction of table motion and a final reconstructed image is formed by gridding and Fourier transforming the fully sampled data array. During reconstruction, the phase encodes could be positioned in the k-space plane in the shape of a spiral, in concentric rings, in rays from the center, or in a Cartesian grid. Notably, Brittain does not describe or suggest phase encoding on to an elliptical grid in polar coordinates in a k-space.

Claim 1 recites a method for a medical examination, wherein the method comprises "polar phase encoding to generate a plurality of signals forming datasets representative of an object, wherein the datasets form an elliptical grid in polar coordinates in a k-space."

Brittain does not describe or suggest a method for medical examination, as recited in Claim 1. More specifically, Brittain does not describe or suggest polar phase encoding to generate a plurality of signals forming datasets representative of an object, wherein the datasets form an elliptical grid in polar coordinates in a k-space, as required by Applicants' claimed invention. Rather, in contrast to the present invention, Brittain describes a method for magnetic resonance imaging that uses a spiral sampling of k-space.

Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Brittain.

Claims 2-7, 10, 14, 19, and 20 depend from independent Claim 1. When the recitations of Claims 2-7, 10, 14, 19, and 20 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claims 2-7, 10, 14, 19, and 20 likewise are patentable over Brittain.

Claim 25 recites a magnetic resonance method for medical examinations, wherein the method comprises "injecting a patient with a contrast agent that flows into a vasculature of the patient; acquiring MR signals produced by spins in the vasculature from an MR imaging

system; and polar phase encoding to generate the MR signals forming datasets representative of the patient, wherein the datasets form an elliptical grid in polar coordinates in a k-space."

Brittain does not describe or suggest a magnetic resonance method, as recited in Claim 25. More specifically, Brittain does not describe or suggest polar phase encoding to generate the MR signals forming datasets representative of the patient, wherein the datasets form an elliptical grid in polar coordinates in a k-space, as required by Applicants' claimed invention. Rather, in contrast to the present invention, Brittain describes a method for magnetic resonance imaging that uses a spiral sampling of k-space.

Accordingly, for at least the reasons set forth above, Claim 25 is submitted to be patentable over Matsui.

Accordingly, for at least the reasons set forth above, Applicants respectfully request that the Section 102 rejection of Claims 1-7, 10, 14, 19, 20, and 25 be withdrawn.

The rejection of Claims 1-8, 11, 13, and 15 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent Application Pub. 2002/0175683 to Mertelmeier et al. (hereinafter referred to as "Mertelmeier") is respectfully traversed.

Mertelmeier describes a method for the fast acquisition of a magnetic resonance image including subdividing the imaging zone into sub-regions with an antenna array allocated to each sub-region, using a separate sampling increment along the trajectories for the signals of the individual antennas, and reconstructing the images. Data reconstruction is accomplished by either transforming the data sets onto a Cartesian grid followed by a two dimensional Fourier transformation or by using spatial harmonics. Notably, Mertelmeier does not describe or suggest phase encoding on to an elliptical grid of polar coordinates in a k-space.

Claim 1 recites a method for a medical examination, wherein the method comprises "polar phase encoding to generate a plurality of signals forming datasets representative of an object, wherein the datasets form an elliptical grid in polar coordinates in a k-space."

Mertelmeier does not describe or suggest a method for a medical examination, as recited in Claim 1. More specifically, Mertelmeier does not describe or suggest polar phase encoding to generate a plurality of signals forming datasets representative of an object, wherein the datasets form an elliptical grid in polar coordinates in a k-space, as required by Applicants' claimed invention. Rather, in contrast to the present invention, Mertelmeier describes a method for the fast acquisition of a magnetic resonance image wherein data reconstruction is accomplished by either transforming the data sets onto a Cartesian grid followed by a two dimensional Fourier transformation or by using spatial harmonics.

Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Mertelmeier.

Claims 2-8, 11, 13, and 15 depend from independent Claim 1. When the recitations of Claims 2-8, 11, 13, and 15 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claims 2-8, 11, 13, and 15 likewise are patentable over Mertelmeier.

For at least the reasons set forth above, Applicants respectfully request that the Section 102 rejection of Claims 1-8, 11, 13, and 15 be withdrawn.

The rejection of Claims 16 and 18 under 35 U.S.C. § 103(a) as being unpatentable over Matsui in view of U.S. Patent 6,068,595 to Miyazaki et al. (hereinafter referred to as "Miyazaki") is respectfully traversed.

Matsui is described above. Miyazaki describes a method of magnetic resonance imaging that produces an image without the loss of information of directivities exhibited by blood flows or tissues running in diverse directions. Data reconstruction is accomplished either through a Fourier transform of raw data acquired by magnetic scan under a state wherein pulsed gradients are applied to the subject in phase-encoding, or through pixel addition or maximum intensity projection (MIP). Notably, Miyazaki does not describe or suggest phase encoding on to an elliptical grid in polar coordinates in a k-space.

Applicants respectfully submit that the Section 103 rejection of the presently pending claims is not a proper rejection. As is well established, obviousness cannot be established by combining the teachings of the cited art to produce the claimed invention, absent some teaching, suggestion, or incentive supporting the combination. Neither Matsui nor Miyazaki, considered alone or in combination, describes or suggests the claimed combination. Further, in contrast to the Examiner's assertion within the Office Action, Applicants respectfully submit that it would not be obvious to one skilled in the art to combine Matsui and Miyazaki because there is no motivation to combine the references suggested in the art. Additionally, the Examiner has not pointed to any prior art that teaches or suggests to combine the disclosures, other than Applicants' own teaching. Rather, only the conclusory statement that "it would have been obvious to one having ordinary skill in the art at the time the invention was made to use MIP, as taught by Miyazaki, in the method of Matsui" suggests combining the disclosures.

As the Federal Circuit has recognized, obviousness is not established merely by combining references having different individual elements of pending claims. Ex parte Levengood, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993). MPEP § 2143.01. Rather, some suggestion to combine such references and a reasonable expectation of success must both be found in the prior art, and not based on Applicant's disclosure. In re Vaeck , 20 USPQ2d 1436 (Fed. Cir. 1991). In the present case, neither a suggestion nor motivation to combine the prior art disclosures, or any reasonable expectation of success has been shown.

Further, it is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the cited art so that the claimed invention is rendered obvious. Specifically, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the art to deprecate the claimed invention. It is also impermissible to pick and choose from any one reference only so much of it as will support a given position to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The present Section 103 rejection is based on a combination of teachings selected in an attempt to arrive at the claimed invention. Since there is no teaching or suggestion in the cited art for the combination, the

Section 103 rejection appears to be based on a hindsight reconstruction in which isolated disclosures have been picked and chosen in an attempt to deprecate the present invention. Of course, such a combination is impermissible, and for this reason alone, Applicants request that the Section 103 rejection be withdrawn.

If art "teaches away" from a claimed invention, such a teaching supports the nonobviousness of the invention. U.S. v. Adams, 148 USPQ 479 (1966); Gillette Co. v. S.C. Johnson & Son, Inc., 16 USPQ2d 1923, 1927 (Fed. Cir. 1990). In light of this standard, it is respectfully submitted that the cited art, as a whole, is not suggestive of the presently claimed invention. Moreover, Applicants respectfully submit Matsui and Miyazaki each teach away from the method for a medical examination, as is recited in Claim 1. Specifically, Matsui is directed a method for magnetic resonance imaging that uses a spiral or circular sampling of k-space, and Miyazaki is directed to a method for magnetic resonance imaging that uses pixel addition or maximum intensity projection. As such, neither Matsui nor Miyazaki, considered alone or in combination, describes or suggests phase encoding on to an elliptical grid in polar coordinates in a k-space, as recited in Claim 1. Accordingly, Applicants respectfully submit that the cited art as a whole teaches away from the method for a medical examination as recited. Moreover, Applicants traverse the suggestion in the Office Action at page 4 that "it would have been obvious to one having ordinary skill in the art at the time the invention was made to use MIP, as taught by Miyazaki" in view of the cited art. For the reasons stated above, Applicants submit that it would not be obvious to use MIP.

Moreover, neither Matsui nor Miyazaki, considered alone or in combination, describes or suggests the claimed invention. Claims 16 and 18 depend from independent Claim 1 which recites a method for a medical examination, wherein the method comprises "polar phase encoding to generate a plurality of signals forming datasets representative of an object, wherein the datasets form an elliptical grid in polar coordinates in a k-space."

Neither Matsui nor Miyazaki, considered alone or in combination, describes or suggests a method for a medical examination, as recited in Claim 1. More specifically, neither Matsui nor Miyazaki, considered alone or in combination, describes or suggests polar phase encoding to generate a plurality of signals forming datasets representative of an object,

wherein the datasets form an elliptical grid in polar coordinates in a k-space, as required by Applicants' claimed invention. Rather, in contrast to the present invention, Matsui describes a method for magnetic resonance imaging that uses a spiral or circular sampling of k-space, and Miyazaki describes a method for magnetic resonance imaging that uses pixel addition or maximum intensity projection.

Accordingly, for at least the reasons set forth above, Claim 1 is submitted to be patentable over Matsui in view of Miyazaki.

Claims 16 and 18 depend from independent Claim 1. When the recitations of Claims 16 and 18 are considered in combination with the recitations of Claim 1, Applicants submit that dependent Claims 16 and 18 likewise are patentable over Matsui in view of Miyazaki.

Accordingly, for at least the reasons set forth above, Claims 16 and 18 are submitted to be patentable over Matsui in view of Miyazaki.

For at least the reasons set forth above, Applicants respectfully request that the Section 103 rejection of Claims 16 and 18 be withdrawn.

In view of the foregoing amendment and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully submitted,

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